A MicroTurbine Project for City of Charlotte

Presented by

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Distributed Energy Roadshow
Clemson, SC
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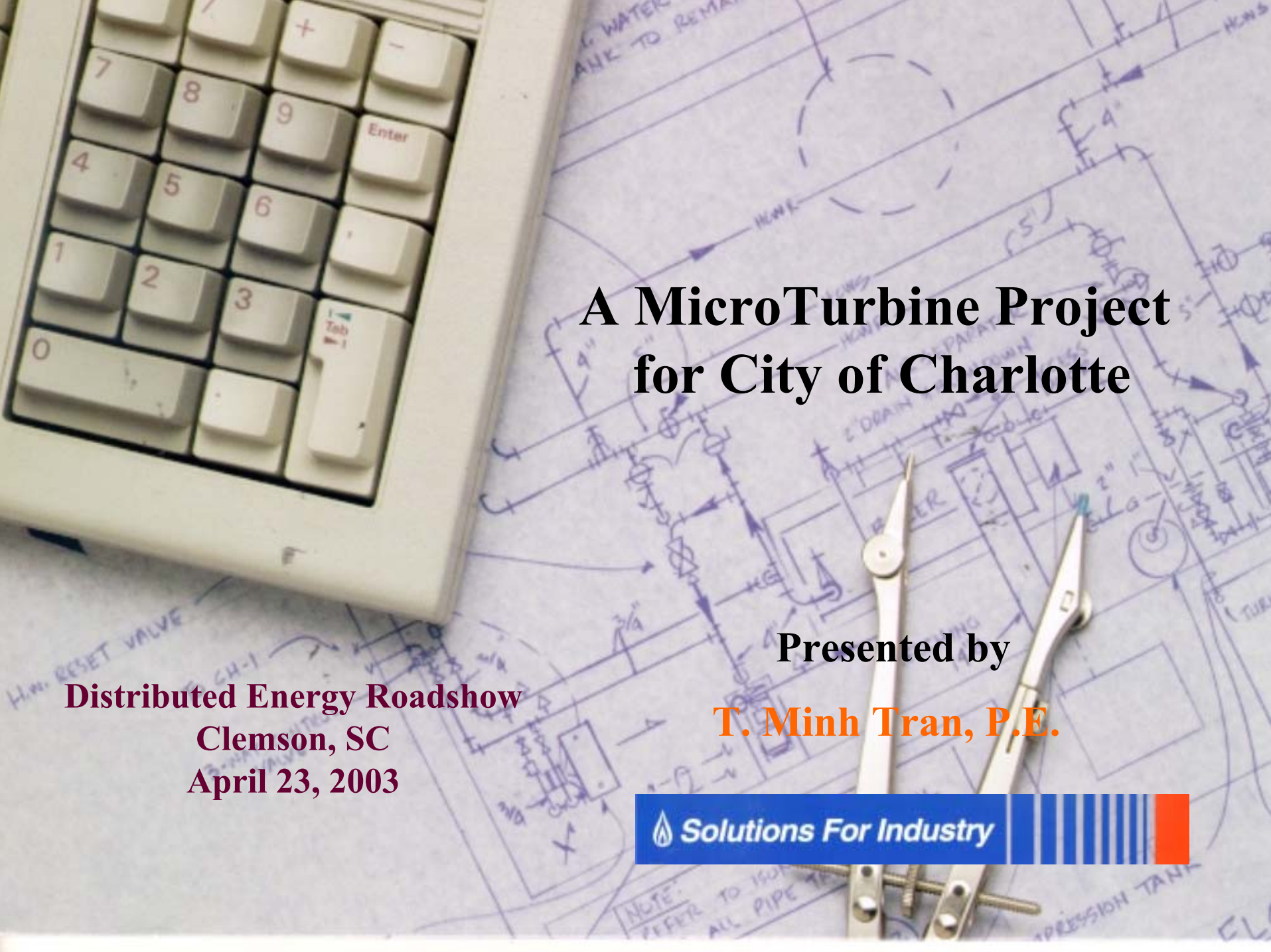

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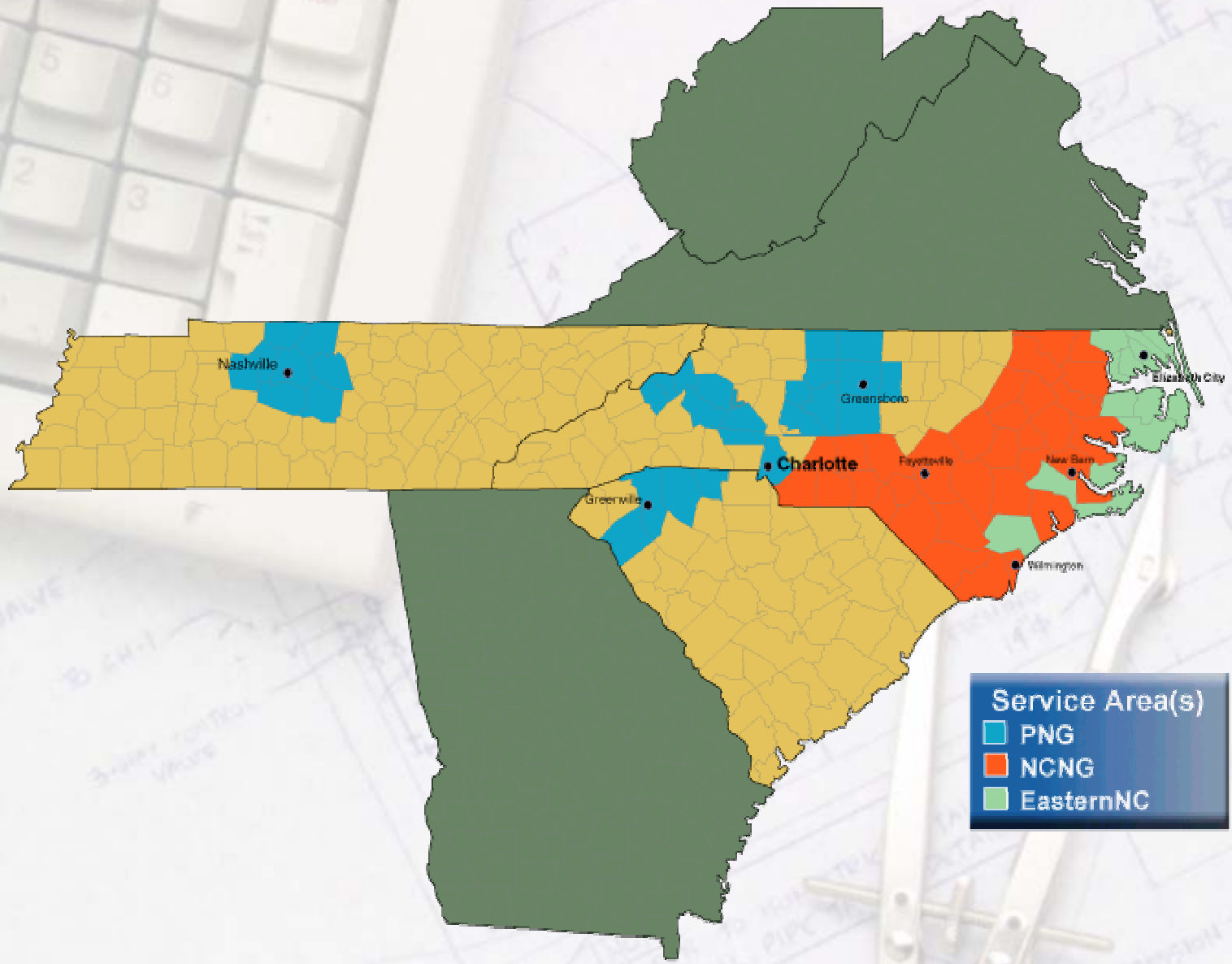


Piedmont and Duke Energy signed joint project agreement

PNG-Duke Microturbine Project Agreement

Scope -- 4 Phases

- Phase 1 - Conception
- Phase 2 - Processes and procedures
- Phase 3 - Installation and testing
- Phase 4 - Analysis and reporting

Project Goals - DE / PNG

- Install 1 or 2- 28 KW Units (12 to 18 months test)
  - Partner w/ Customer
  - Capture customer impact
  - Verify Vendor Claims
  - Operate to provide base energy

OEM Claims

- Minimal Maintenance
- Ultra Low Emission
- Small Footprint
- Low Noise
- Provide Stand By / Black Start Power
- Optional Thermal Energy Recovery
- Choice of Electric Power Source

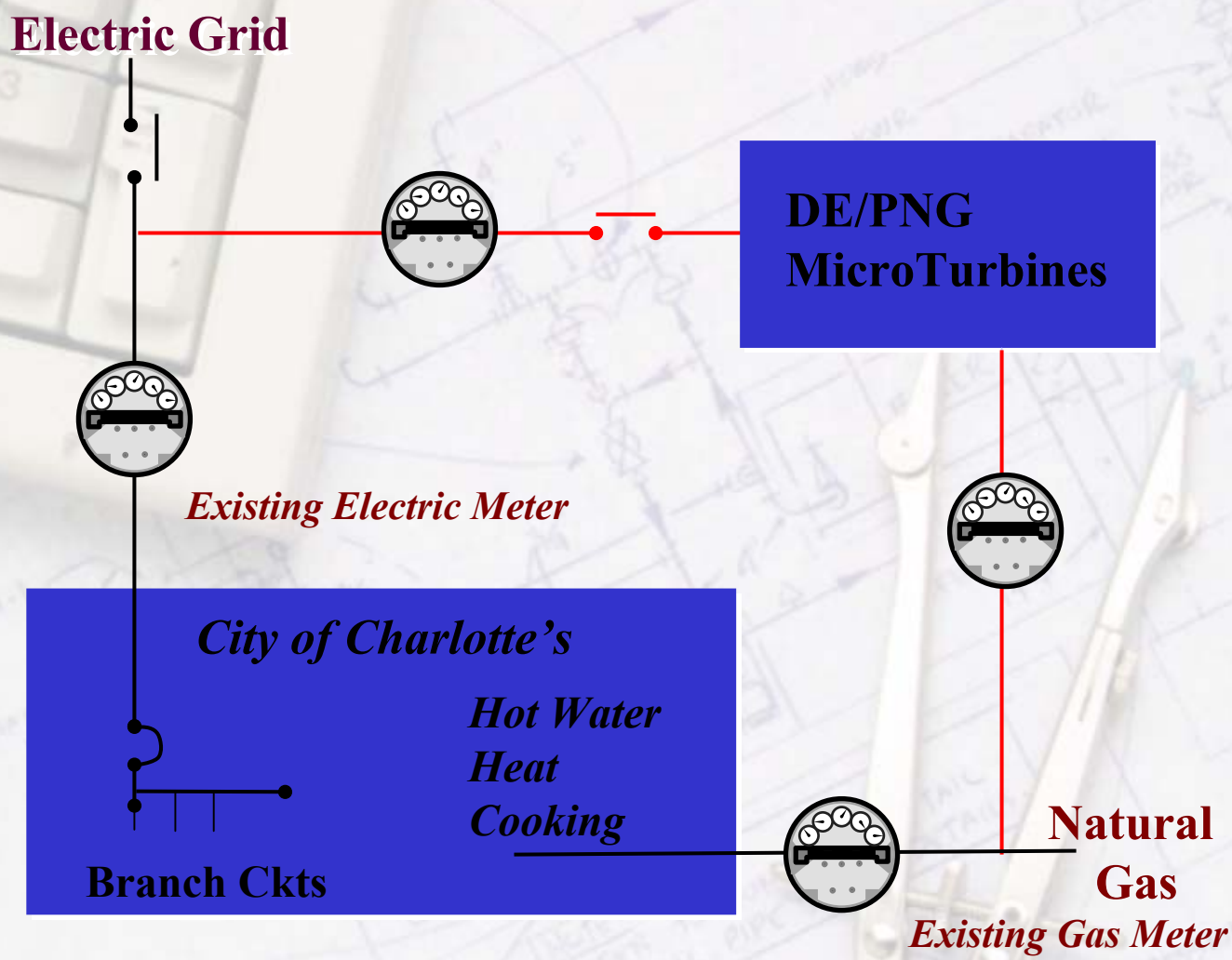
Project Goals - DE / PNG
Continued

- Install 2- 28 KW Units (12 to 18 months test)
  - Perform Black start testing
  - Simulate power outage operation during off-hours
  - Determine heat recovery potential / value
  - Evaluate remote operation / monitoring
  - Evaluate the cost of ownership

Partnership Goals

- Be virtually transparent to Partner
  - No effect on daily operation
    - Retain grid connection
    - Provide 24 hours, 7 days per week, problem resolution
  - No increased energy cost (electric or gas).
    - Provide separate gas meter for the turbine.
    - Turbine gas is project expense, not customer's

MT Connection



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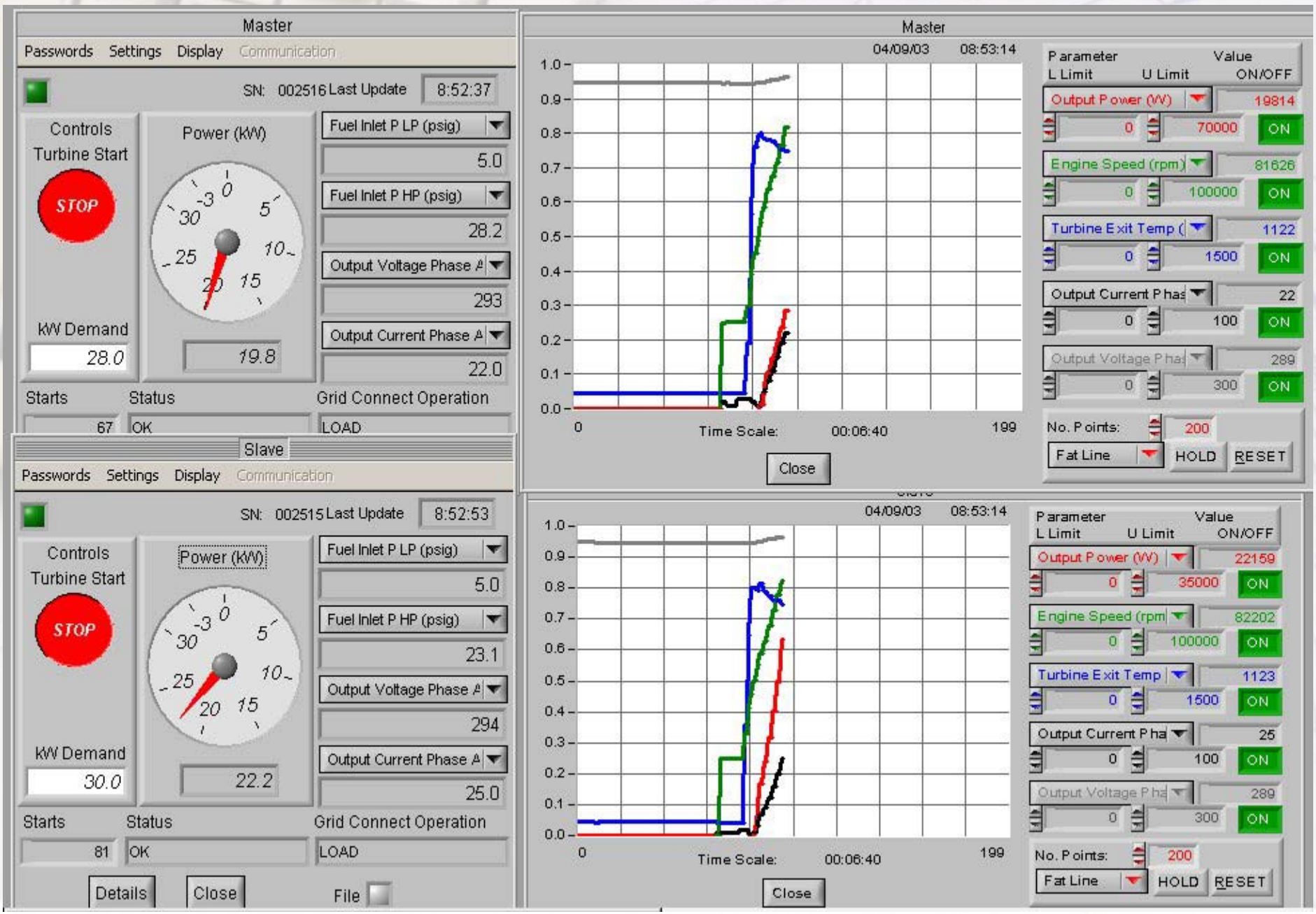
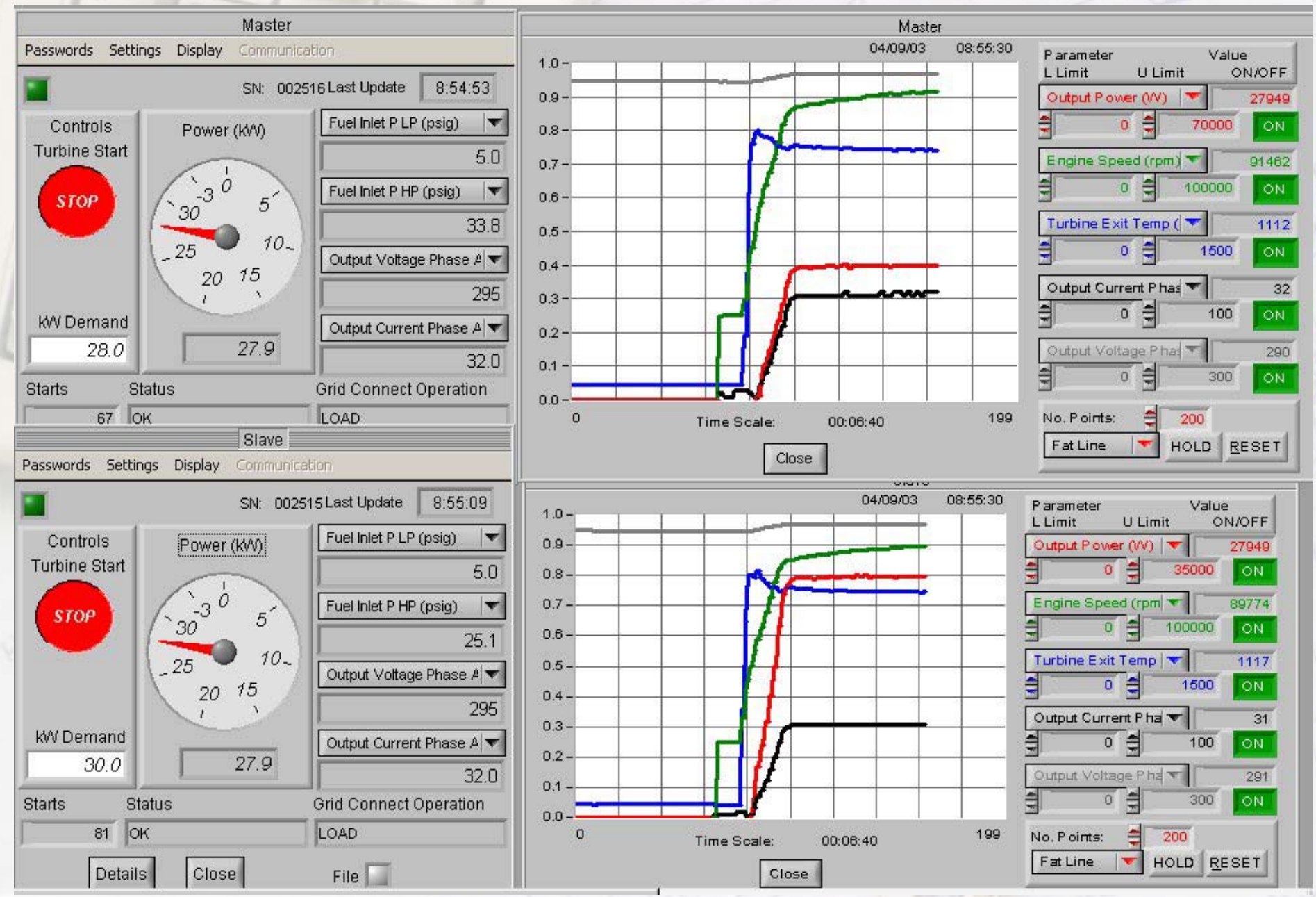
Project Location

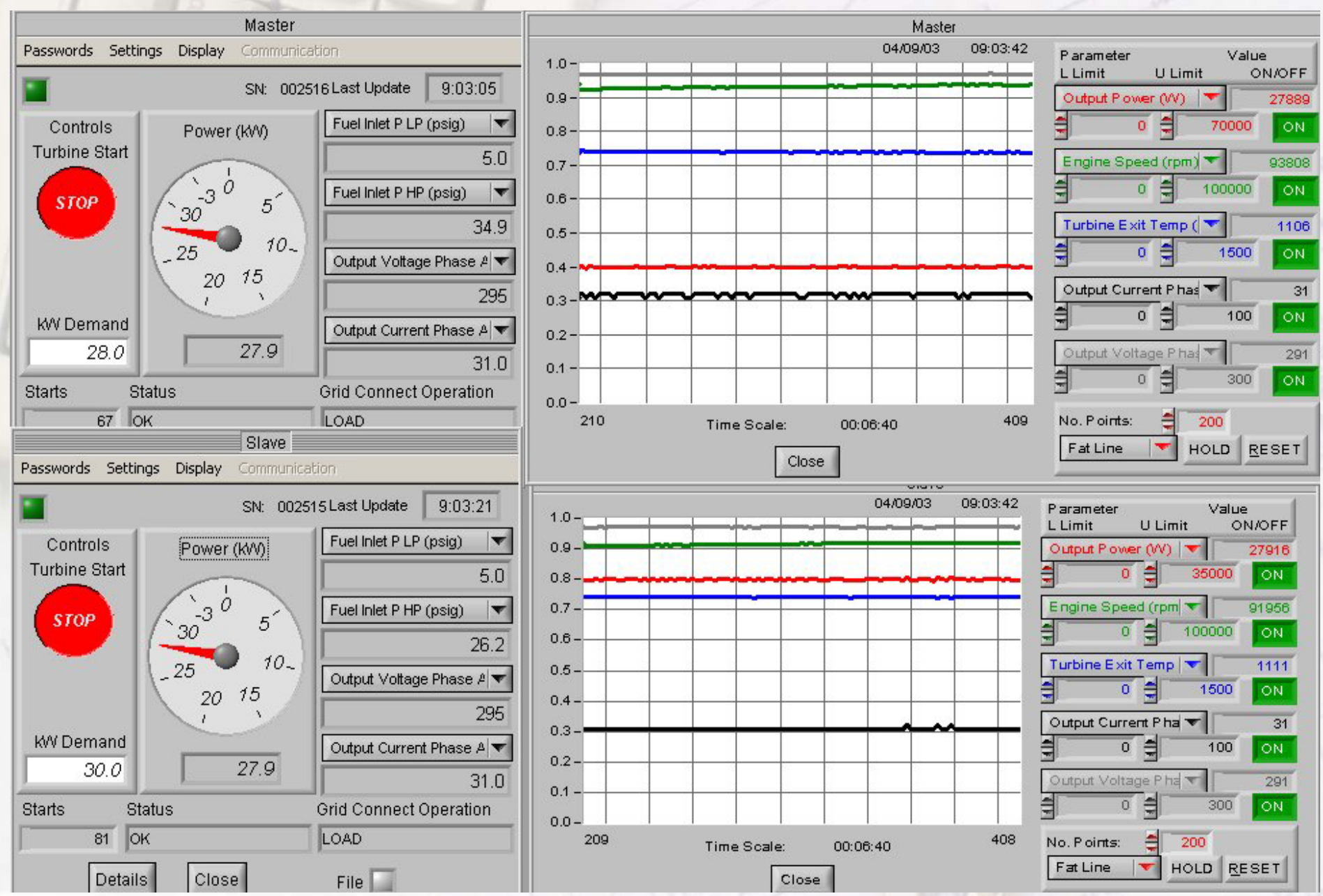

ON
OFF

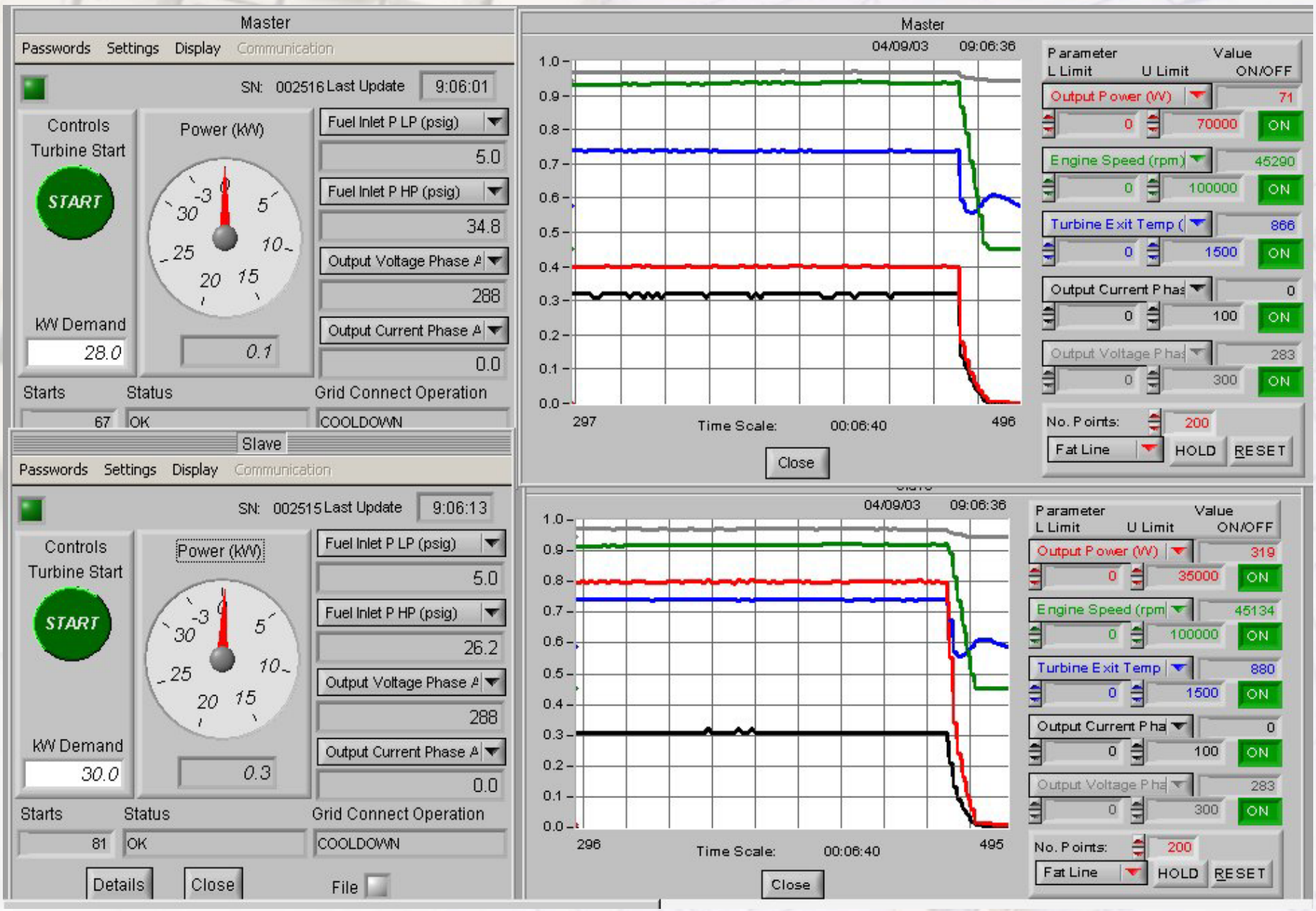

PELIGRO

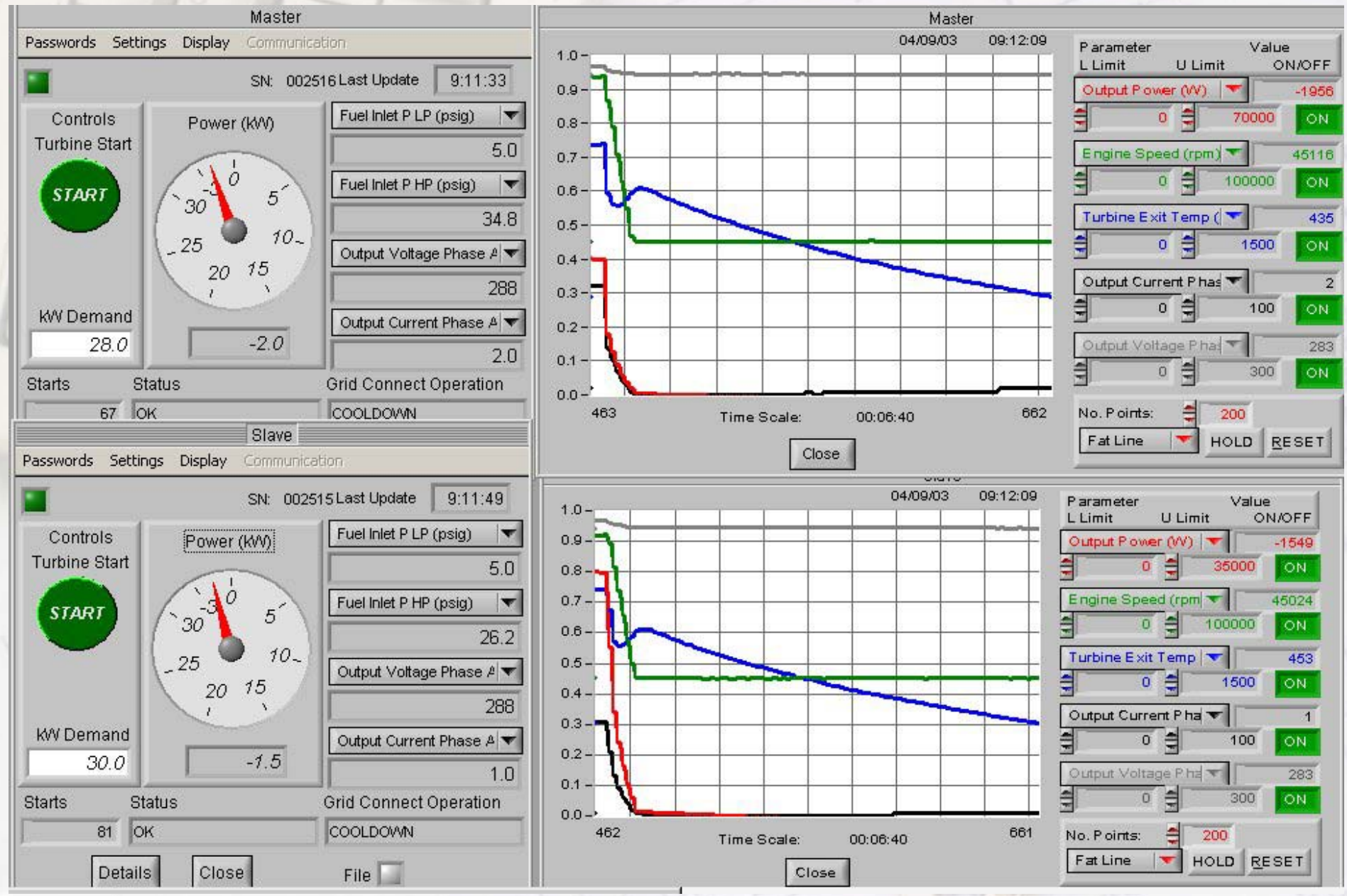

1
2
3
4
5
6
7
8
9
+/-
0
c
Unit Data 11/11
Turbine 1/20
22.8 kW 2/21
28.0 Dmd
ACCEPT


Master
Passwords Settings Display Communication
SN: 002516 Last Update 8:52:37
Controls
Turbine Start
STOP
kW Demand
28.0
Power (kW)
19.8
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
28.2
Output Voltage Phase A
293
Output Current Phase A
22.0
Starts
67
Status
OK
Grid Connect Operation
LOAD
Slave
Passwords Settings Display Communication
SN: 002515 Last Update 8:52:53
Controls
Turbine Start
STOP
kW Demand
30.0
Power (kW)
22.2
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
23.1
Output Voltage Phase A
294
Output Current Phase A
25.0
Starts
81
Status
OK
Grid Connect Operation
LOAD
Details
Close
File
Master
04/09/03 08:53:14
Time Scale: 00:06:40
Close
Parameter
L Limit U Limit ON/OFF
Output Power (W) 19814
0 70000 ON
Engine Speed (rpm) 81626
0 100000 ON
Turbine Exit Temp (1122
0 1500 ON
Output Current Phas 22
0 100 ON
Output Voltage Phas 289
0 300 ON
No. Points: 200
Fat Line HOLD RESET
04/09/03 08:53:14
Time Scale: 00:06:40
Close
Parameter
L Limit U Limit ON/OFF
Output Power (W) 22159
0 35000 ON
Engine Speed (rpm 82202
0 100000 ON
Turbine Exit Temp 1123
0 1500 ON
Output Current Pha 25
0 100 ON
Output Voltage Pha 289
0 300 ON
No. Points: 200
Fat Line HOLD RESET


Master
Passwords Settings Display Communication
SN: 002516 Last Update 8:54:53
Controls
Turbine Start
STOP
kW Demand
28.0
Power (kW)
27.9
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
33.8
Output Voltage Phase A
295
Output Current Phase A
32.0
Starts
67
Status
OK
Grid Connect Operation
LOAD
Slave
Passwords Settings Display Communication
SN: 002515 Last Update 8:55:09
Controls
Turbine Start
STOP
kW Demand
30.0
Power (kW)
27.9
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
25.1
Output Voltage Phase A
295
Output Current Phase A
32.0
Starts
81
Status
OK
Grid Connect Operation
LOAD
Details
Close
File
Master
04/09/03 08:55:30
Time Scale: 00:06:40
Close
Parameter
L Limit U Limit
Value
ON/OFF
Output Power (W) 27949
0 70000 ON
Engine Speed (rpm) 91462
0 100000 ON
Turbine Exit Temp (1112
0 1500 ON
Output Current Phas 32
0 100 ON
Output Voltage Phas 290
0 300 ON
No. Points: 200
Fat Line
HOLD
RESET
04/09/03 08:55:30
Time Scale: 00:06:40
Close
Parameter
L Limit U Limit
Value
ON/OFF
Output Power (W) 27949
0 35000 ON
Engine Speed (rpm 89774
0 100000 ON
Turbine Exit Temp 1117
0 1500 ON
Output Current Pha 31
0 100 ON
Output Voltage Pha 291
0 300 ON
No. Points: 200
Fat Line
HOLD
RESET


Master
Passwords Settings Display Communication
SN: 002516 Last Update 9:03:05
Controls
Turbine Start
STOP
kW Demand
28.0
Power (kW)
27.9
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
34.9
Output Voltage Phase A
295
Output Current Phase A
31.0
Starts
67
Status
OK
Grid Connect Operation
LOAD
Slave
Passwords Settings Display Communication
SN: 002515 Last Update 9:03:21
Controls
Turbine Start
STOP
kW Demand
30.0
Power (kW)
27.9
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
26.2
Output Voltage Phase A
295
Output Current Phase A
31.0
Starts
81
Status
OK
Grid Connect Operation
LOAD
Details
Close
File
Master
04/09/03 09:03:42
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
210
Time Scale: 00:06:40
409
Close
Parameter
L Limit U Limit
Value
ON/OFF
Output Power (W)
0 70000
27889
ON
Engine Speed (rpm)
0 100000
93808
ON
Turbine Exit Temp (
0 1500
1106
ON
Output Current Phas
0 100
31
ON
Output Voltage Phas
0 300
291
ON
No. Points:
200
Fat Line
HOLD
RESET
04/09/03 09:03:42
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
209
Time Scale: 00:06:40
408
Close
Parameter
L Limit U Limit
Value
ON/OFF
Output Power (W)
0 35000
27916
ON
Engine Speed (rpm
0 100000
91956
ON
Turbine Exit Temp
0 1500
1111
ON
Output Current Pha
0 100
31
ON
Output Voltage Pha
0 300
291
ON
No. Points:
200
Fat Line
HOLD
RESET


Master
Passwords Settings Display Communication
SN: 002516 Last Update 9:06:01
Controls
Turbine Start
START
kW Demand
28.0
Power (kW)
0.1
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
34.8
Output Voltage Phase A
288
Output Current Phase A
0.0
Starts
67
Status
OK
Grid Connect Operation
COOLDOWN
Slave
Passwords Settings Display Communication
SN: 002515 Last Update 9:06:13
Controls
Turbine Start
START
kW Demand
30.0
Power (kW)
0.3
Fuel Inlet P LP (psig)
5.0
Fuel Inlet P HP (psig)
26.2
Output Voltage Phase A
288
Output Current Phase A
0.0
Starts
81
Status
OK
Grid Connect Operation
COOLDOWN
Details
Close
File
Master
04/09/03 09:06:36
297
Time Scale: 00:06:40
496
Close
Parameter
L Limit
U Limit
Value
ON/OFF
Output Power (W) 71
0 70000 ON
Engine Speed (rpm) 45290
0 100000 ON
Turbine Exit Temp (866
0 1500 ON
Output Current Phas 0
0 100 ON
Output Voltage Phas 283
0 300 ON
No. Points: 200
Fat Line
HOLD
RESET
04/09/03 09:06:36
296
Time Scale: 00:06:40
495
Close
Parameter
L Limit
U Limit
Value
ON/OFF
Output Power (W) 319
0 35000 ON
Engine Speed (rpm 45134
0 100000 ON
Turbine Exit Temp 880
0 1500 ON
Output Current Pha 0
0 100 ON
Output Voltage Pha 283
0 300 ON
No. Points: 200
Fat Line
HOLD
RESET




Thank You
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